

Report **

A prelude to the Caucasus Barcode of Life Platform (CaBOL): Biodiversity Days in Georgia in 2018 and 2019

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Abstract. Here we report on collaborative expeditions run by ISU (Ilia State University, Tbilisi), ZFMK (Zoologisches Forschungsmuseum Alexander Koenig, Bonn) and external taxonomists in Georgia in 2018 and 2019 as part of the renewed close cooperation between Germany and Caucasus countries aiming at the exploration of biodiversity in the Caucasus region. The 2018 and 2019 field work campaigns serve as a starting point for a larger cooperative venture, planned to start in 2020 – the Caucasus Barcode of Life Platform (CaBOL). To encourage participation by additional partners and to build an active expert network, we here describe the so-far collected material and collection methods, provide detailed information on collecting sites and the diversity of habitats and outline the goals of the planned CaBOL project. Building on experiences from the German Barcode of Life (GBOL) initiative, our goal is to increase expertise and capacity in the region for modern integrative taxonomy approaches.

Keywords. GBOL, GGBC, DNA barcoding, Kintrishi, Kazbegi.

აბსტრაქტი

წინამდებარე ნაშრომში წარმოდგენილია სახელმწიფო უნივერსიტეტის (ISU), ალექსანდრ კონიგის ზოოლოგიური კვლევითი მუზეუმი (ZFMK) და სხვა ტექნიკური მონაწილეობისა ქართული ბიომრავალფეროვნების შესასწავლად 2018 და 2019 წლებში განხორციელებულ ჯგუფური ექსპედიციების ანგარიშს. ასევე გაგაცნობთ გერმანიასა და კავკასიის ქვეყნებს შორის მიმდინარე აქტიური თანამშრომლობას, რომელსაც მიზნად კავკასიის რეგიონის ბიომრავალფეროვნების ურყეველად მასშტაბური კვლევა. 2018 და 2019 წლებს ექსპედიციები წარმოადგენს საასტრუქონიშნულ ადგილას მასშტაბური თანამშრომლობის რეგიონალური პროექტი – კავკასიის სიცოცხლის ბარკოდირება (CaBOL), რომელსაც დაწყებულია 2020 წლიდან დაგეგმილი დამატებითი პარტნიორობის მიზნად და ჩართვისათვის ამ თანამშრომლობაში და შესაბამისად ბიომრავალფეროვნების ექსპერტების ქსელს გაფართოების ხელშეწყობისათვის, წარმოადგენდა ტალღის აღნიშნული ექსპედიციების პირველი შედეგების და CaBOL პროექტის მიზნებისა და გეგმების შესახებ. გერმანიის სიცოცხლის ბარკოდირების (GBOL) ინიციატივიდან მიღებული გამოცდილების გათვალისწინებით ჩვენი მიზანია რეგიონში გავზარდოთ ბიომრავალფეროვნების შესახებ ცოდნა და ინფრასტრუქტურული/ექსპერტული შესაძლებლობები თანამედროვე ტექნიკური მიდგომების გათვალისწინებით

INTRODUCTION

The Caucasus Region is an area situated between the Black and the Caspian Sea, and is recognized as one of the global biodiversity hotspots (Mittermeier et al. 2004; Myers et al. 2000; Zazanashvili et al. 2004). Where Western Asia meets Eastern Europe, Georgia is bounded to the west by the Black Sea, to the north by Russia, to the south by Turkey and Armenia, and to the southeast by Azerbai-

jan. While making rapid strides towards modernization of its research and educational capacity, Georgia still lacks some key elements in both expertise and infrastructure. Targeted investment in science and education in Georgia is one of the major goals of our research collaboration, and perhaps the best way to develop and augment capacity for the essential biodiversity assessment *in situ*. It is most effective in close cooperation with an experienced partner. Germany and the Zoological Research Museum

Alexander Koenig, Bonn (ZFMK) are leaders in biodiversity research within Europe, for example, coordinating the German Barcode of Life (GBOL) initiative that has been successfully run for the last eight years and has delivered an operative DNA barcode reference library for German animals, plants and fungi (Geiger et al. 2016). Based on this Germany-focused biodiversity research, scientists from Georgia and Germany decided to launch a collaborative initiative to adapt the structure and strategy of the GBOL project to enable comprehensive biodiversity research in the species-rich Caucasus region. This paper documents the joint field work done so far, and gives an overview of the ongoing and future collaboration.

PREVIOUS PROJECTS AND TRANSFER OF DNA BARCODING WORKFLOWS

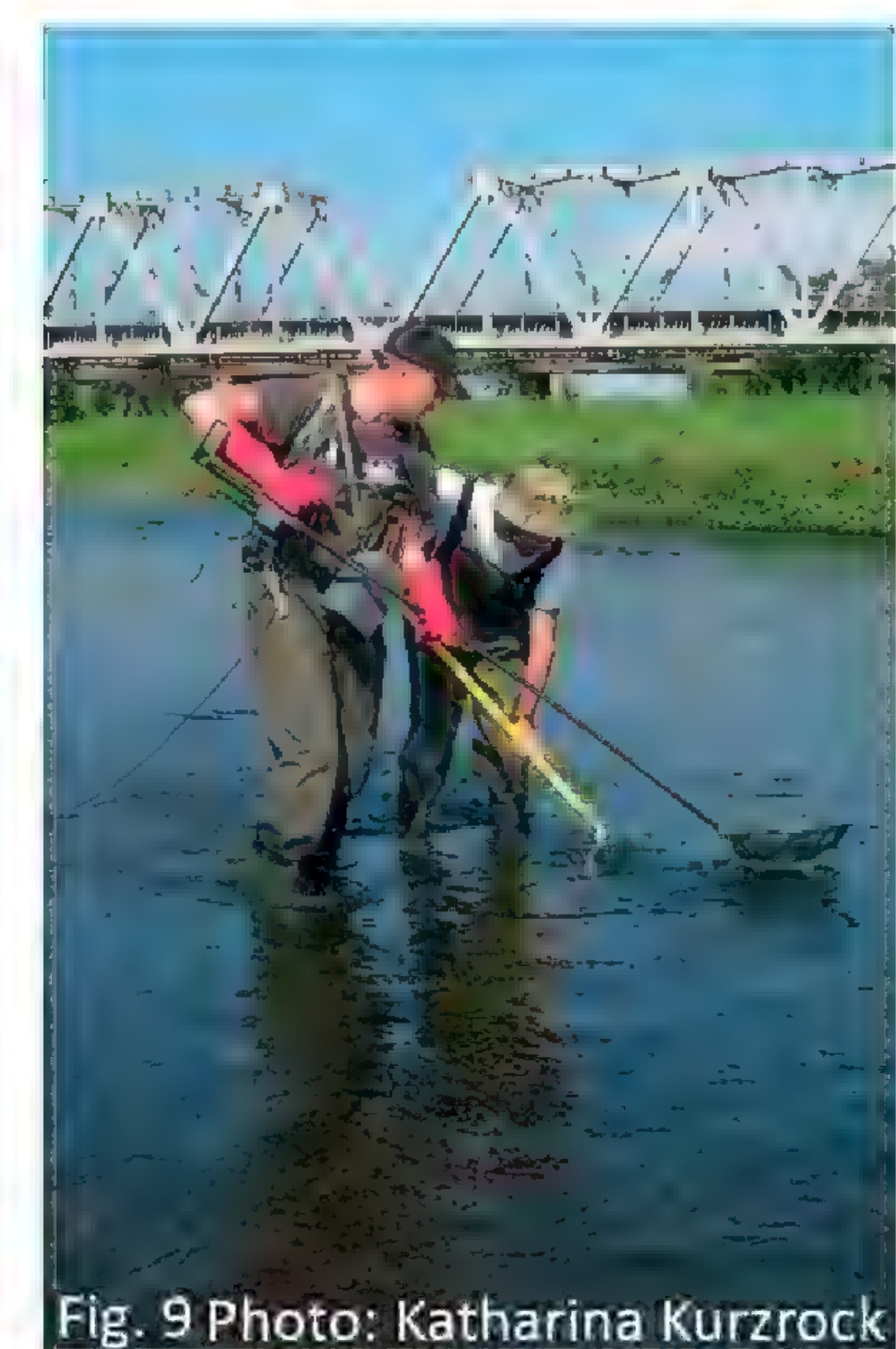
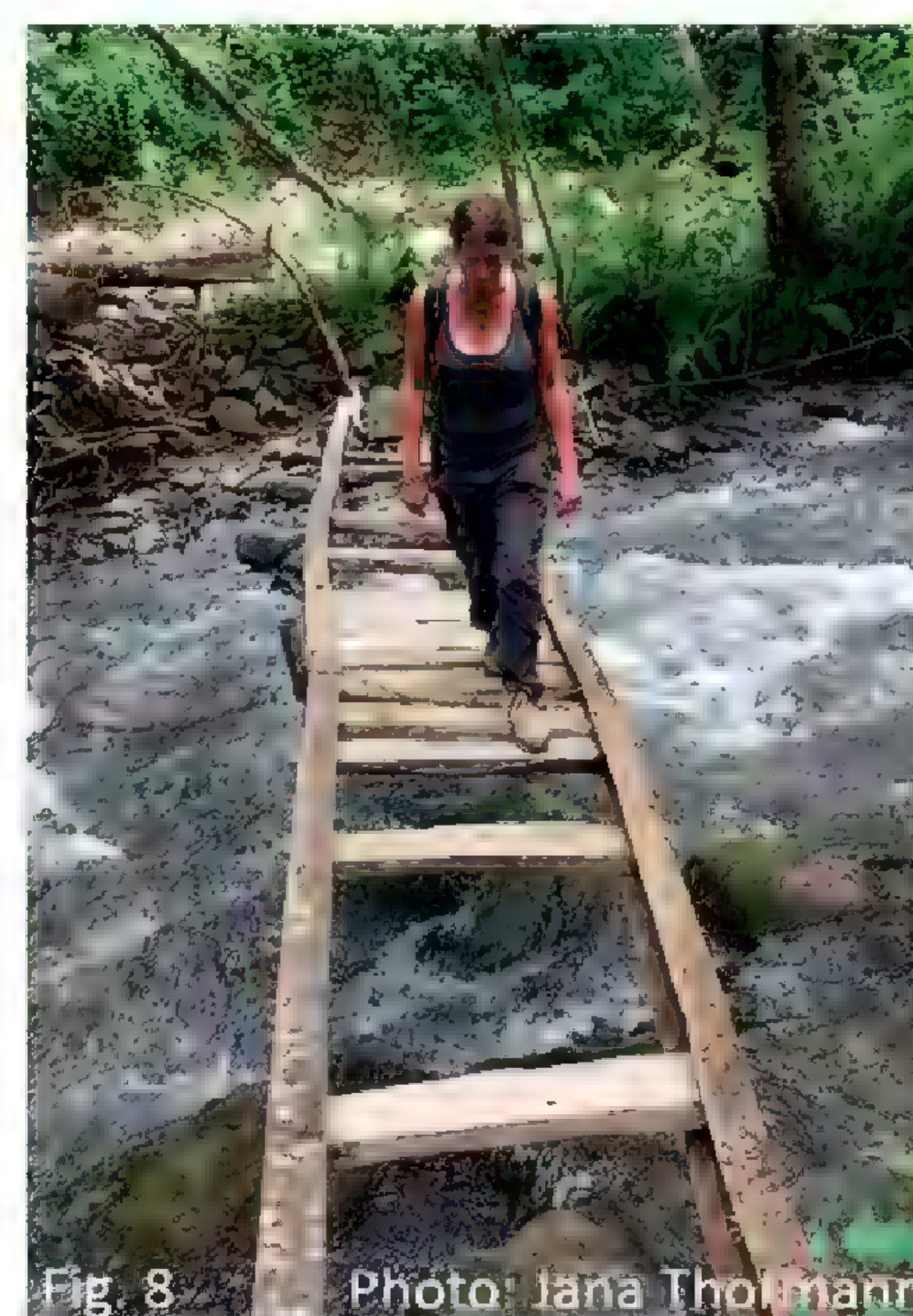
Since 2012 ZFMK has led the GBOL project in which several German research institutions successfully worked together on a high-throughput sequencing pipeline to create an extensive DNA barcode library (Hebert et al. 2003a, 2003b) of the German fauna, flora and fungi in order to assess and access the national biodiversity (e.g., Raupach et al. 2014, Wesener et al. 2015, Astrin et al. 2016, Morinière et al. 2017, Rulik et al. 2017). Applying DNA barcodes for species identification and delimitation requires a database of reference sequences. In order to develop such a reference library, concerted efforts of taxonomists, biodiversity data specialists, and experts on molecular techniques are necessary. In 2017, the ZFMK made the first steps for a knowledge transfer from the GBOL project to Georgia, a country with a considerable need and potential for barcode-aided biodiversity assessment (Mumladze et al. 2019). In September 2017, a proposal for the development of a Georgian-German biodiversity center (GGBC) was granted by the German Federal Ministry of Education and Research (BMBF) (project's website: <https://ggbc.eu/>). The goal of the GGBC is to establish an infrastructure and to provide suitable training that allows the long-term development of a DNA barcode reference database for Georgia.

The operational infrastructure of the GBOL initiative is supposed to serve as a model, guiding the development of a comparable structure in Georgia. Such developments of the relevant infrastructures are planned to go hand in hand with taxonomic and methodological training of Georgian students, species identification by taxonomic experts, as well as molecular laboratory work. To this end, a lively exchange of students and researchers has already been established between ISU (Ilia State University, Tbilisi) and ZFMK.

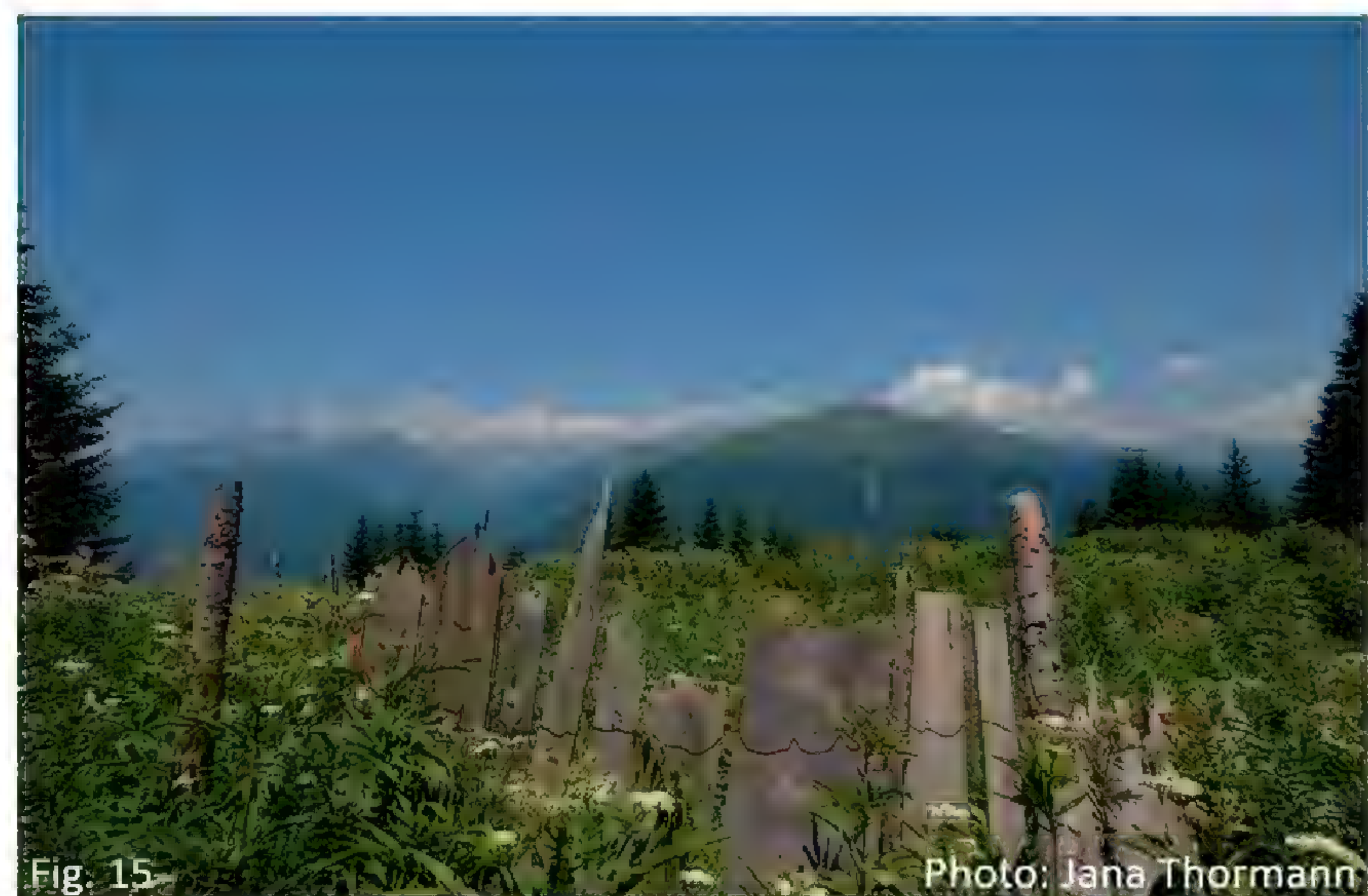
THE KINTRISHI PROJECT: MALAISE TRAP TRANSECT & BIODIVERSITY DAYS 2018

Within the framework of GGBC, the Kintrishi project was the first pilot project launched by the ISU-ZFMK collaborative team in April 2018. The project aimed to investigate the biodiversity in the Kintrishi Protected Areas and to start compiling a Georgian reference database of DNA barcodes for selected taxa. Created in 1959, the Kintrishi National Park is located in south-western Georgia (41°75' N, 42°03' E) and currently encompasses over 13,893 hectares (APA, 2019). Together with the adjacent Mtirala National Park, Kintrishi is the most humid area in the Caucasus region, with an annual precipitation of around 2500 mm (Neidze, 2003). It is a Plio-Pleistocene refugium featuring many relict and endemic animal and plant species (Kikvidze & Ohsawa 1999, Denk et al. 2001, Milne & Abbott 2002, Shatilova et al. 2011, Tarkhnishvili et al. 2011). The park ranges from 300 m up to 2,500 m a.s.l. and includes pristine mountain humid forests and subalpine/alpine habitats. Although the high level of biodiversity in Kintrishi was recognized early in the 20th century a validated catalog of animal and plant taxa in Kintrishi and surroundings is still lacking (Garsztecki 2017).

In April 2018, Björn Rulik and Ameli Kirse from the ZFMK spent two weeks in Georgia. Together with Levan Mumladze (ISU) and a group of Georgian students they set up Malaise traps along an elevational gradient in the Kintrishi gorge, from the lower reaches of the Kintrishi River (400 m a.s.l.) up to alpine meadows (2,500 m a.s.l.). Three trap replicates were placed at each of the six selected elevation levels (i.e., 18 traps in total) (Figs 1–3). The traps were emptied every two weeks by a team of Georgian students: Eka Arsenashvili, Giorgi Bakuradze, Giorgi Bananashvili, Giorgi Chikorashvili, Shota Japarashvili, Tinatin Chkhartishvili, Giorgi Iankoshvili, Elisabeth Karalashvili, Revaz Kvaratskhelia, Natia Rtskhiladze, Nutsa Rtskhiladze, Alisa Sanakoeva, Anano Shubashishvili, Irina Tsereteli and Mari Tsulaia. The traps were operating from April to November 2018. From the collected samples several taxa were then sorted out at ISU and prepared for further taxonomic research and DNA barcoding, using equipment purchased by the GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit; see below). Since the amount of collected material was very large, this work is still in progress and we are currently focusing on some selected groups of animals (several families of dipterans, hymenopterans, and beetles; spiders, pseudoscorpions and myriapods). The proximate goal is to evaluate multi-taxon species diversity and community structure over an elevation gradient. Furthermore, microclimate data logger stations registering air temperature, soil temperature, relative humidity and solar radiation were installed along the transect.



Figs 1–9. The Kintrishi Project. 1. Björn Rulik (ZFMK) and Levan Mumladze (ISU) with ISU students. 2. Malaise trap above the tree line (2500 m). 3. Björn Rulik and Ameli Kirse (ZFMK) teaching students at Grigoleti Research Field Station. 4. Grigoleti field station. 5. Traditional Georgian dinner prepared by local contractors from Grigoleti. 6. On the way to Kintrishi Protected Areas. 7. Just the “normal” way to work. 8. Bridge in Kintrishi Protected Areas. 9. Electrofishing in Kintrishi River.



Figs 10–17. Biodiversity Days 2018. **10.** Curious pigs examining fishing gear. **11.** Changing a flat tire on the way to work. **12.** Bakhmaro. **13.** Sceptical glance in Borjomi NP. **14.** Collecting calves?! (Borjomi NP). **15.** Hill top near Lentekhi. **16.** Traditional dinner in a private accommodation in Lentekhi. **17.** Between Lentekhi and Tsana.

Besides the Malaise trap transect two additional Malaise traps were set up: one was located next to the field station in Grigoleti for one week in April 2018. The other trap was set up close to the rangers' station in Kintrishi, who emptied the trap every other week, alternating with the ISU team. This trap was contributed by the Global Malaise Trap Program (GMP; <https://biodiversitygenomics.net/projects/gmp/>), which is run by the Centre for Biodiversity Genomics, University of Guelph, Canada. After the collecting season the material was sent to Guelph to obtain morphospecies-based barcode sequences.

In addition to Malaise trap sampling, soil samples have been collected along the elevation gradient to run a metabarcoding study of Nematoda diversity and pitfall traps were also set-up to sample ground beetle communities in the Kintrishi area.

In July 2018, a group of Georgian and German scientists, students and external taxon specialists (including citizen scientists) visited the Kintrishi Protected Areas to collect and identify specimens for DNA barcoding within so-called Biodiversity Days (i.e., a concerted, intense multi-taxon field sampling campaign, also referred to as a Bioblitz), the first so far to take place in Georgia. During the core dates (20–22 July) all participants were accommodated at the ISU field station in Grigoleti (Figs 4–5). During the days before and after these core days several groups of scientists also visited other areas of the country (e.g., the Greater Caucasus) to collect specimens (Appendix I: Table 1; Map (Fig. 56), Figs 12–21).

Apart from the pilot project funding by the BMBF (German Federal Ministry of Education and Research), the GIZ Georgia kindly supported this event under the Integrated Biodiversity Management South Caucasus (IBiS) initiative, funded by the BMZ (Federal Ministry for Economic Cooperation and Development). Collecting permits were provided by the Agency of Protected Areas of Georgia and the Ministry of Environment Protection and Agriculture of Georgia.

In addition to the students and scientists who were already involved into the Malaise trap project (listed above) the following researchers participated in the Biodiversity Days 2018: Cort Anderson (ISU), Jonas Astrin (ZFMK – Arthropoda), Ani Bikashvili (ISU – Mollusca), Tim Böhner (Uni Bonn – Botany), Albia Consul (ZFMK – herpetology, Arthropoda), Giorgi Epitashvili (ISU – Fishes), Marianne Espeland (ZFMK – Trichoptera, Lepidoptera), Matthias Geiger (ZFMK – Fishes), Nils Hein (Geographisches Institut der Universität Bonn – Arachnida), Hajo Krammer (ZFMK – Arachnida), Katharina Kurzrock (ZFMK – Mollusca), Ximo Mengual (ZFMK – Diptera), Stefan Otto (independent researcher – Arachnida), André Reimann (GBOL team; Senckenberg Naturhistorische Sammlungen Dresden – Diptera, Scorpiones), Anke Schäfer (GBOL team; independent researcher – Diptera, Botany), David Tarkhnishvili (ISU – herpetology), Birthe Thormann (ZFMK – Coleoptera), Jana Thormann

(ZFMK – Arthropoda), Sönke Twietmeyer (GBOL team; Nationalpark Eifel – Aves, Mammalia), Thomas Wesener (ZFMK – Myriapoda), Benedict Wipfler (ZFMK – Coleoptera).

Combining morphological and molecular data for species investigations, the collecting efforts in 2018 resulted in the submission of a first publication, which gives an updated list of the hoverflies (Diptera, Syrphidae) of Georgia (Mengual et al., submitted). This collaboration of Georgian students and external taxon specialists contributes to the species inventory and DNA barcoding reference library and is an example of the successful cooperation between ISU, ZFMK and external researchers.

BIODIVERSITY DAYS 2019: THE GREATER CAUCASUS

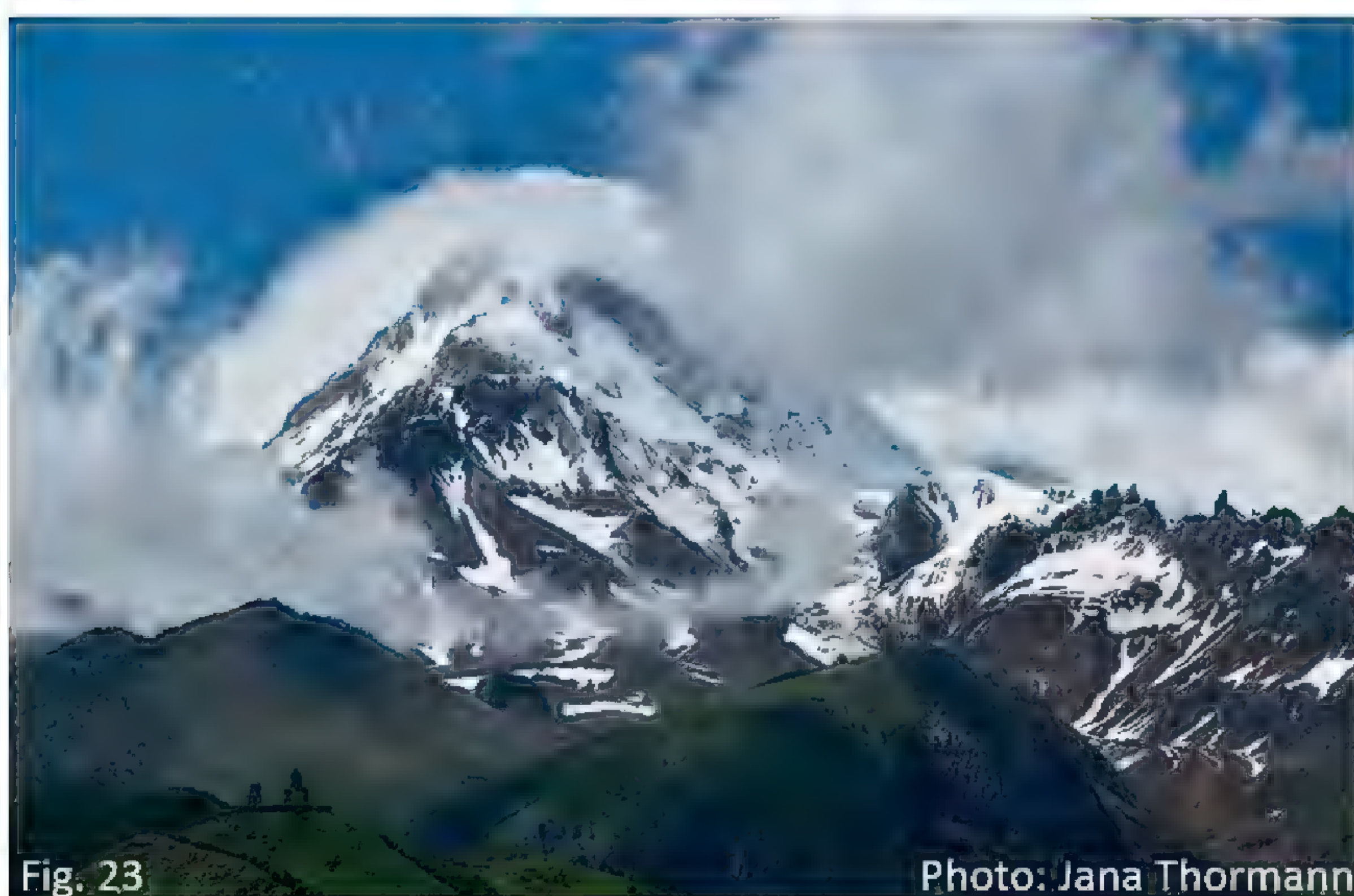
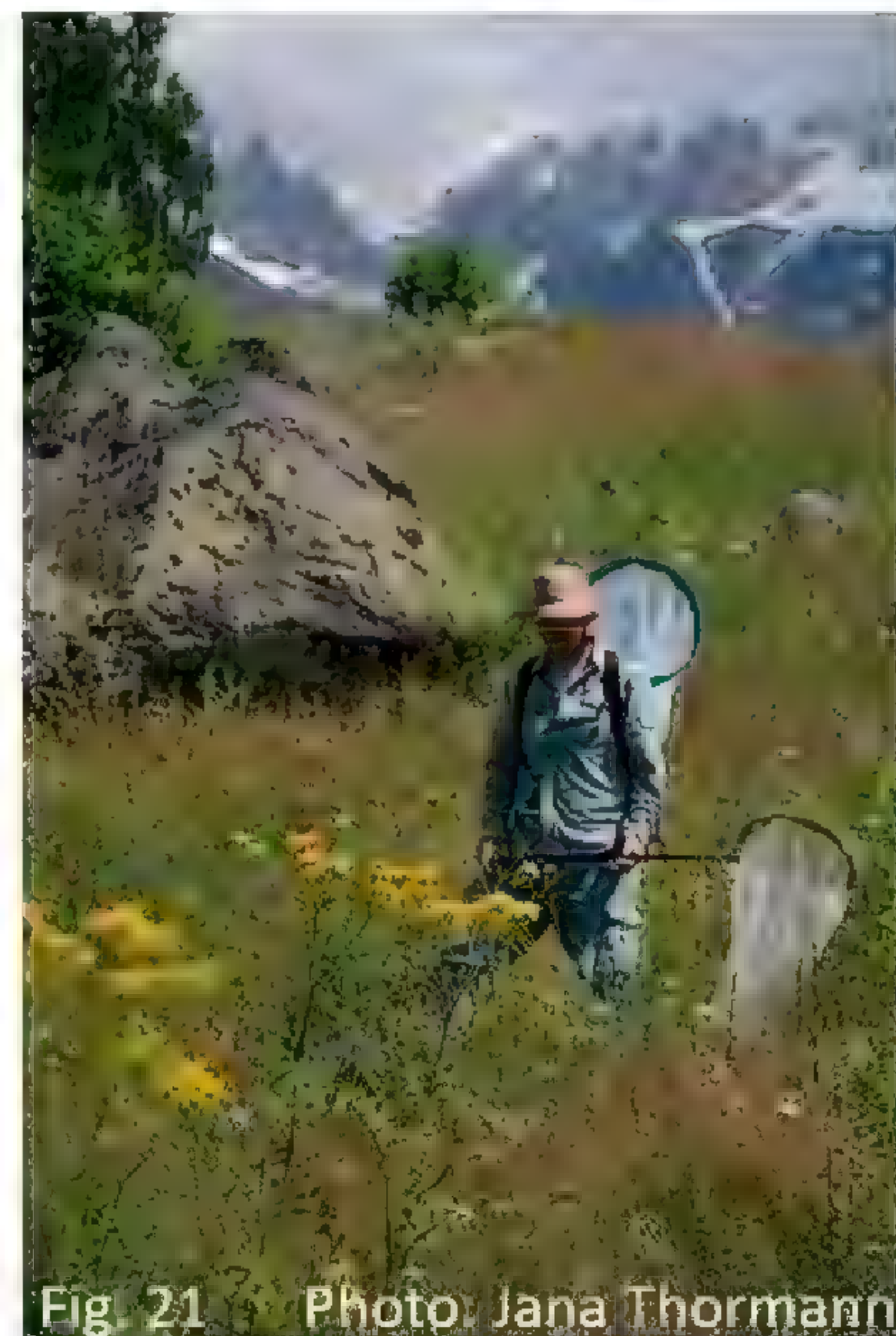
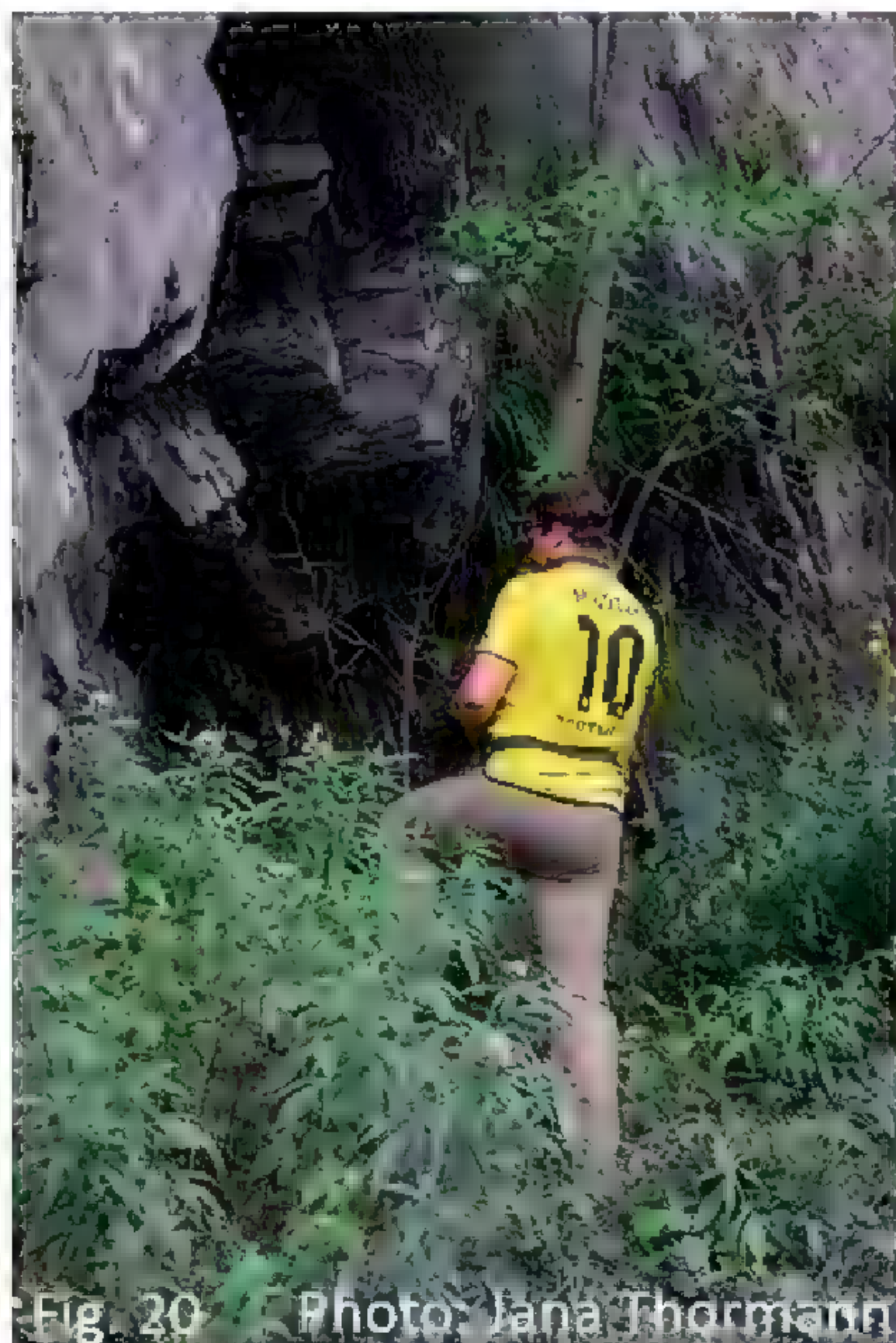
After the successful trip to the Kintrishi area, the Biodiversity Days 2019 took place in the Stepantsminda area (Kazbegi) in the Greater Caucasus. During the core dates (4–7 July 2019) the participants were hosted at the ISU field station in Stepantsminda and, as in the previous year, small groups of scientists also collected in other regions of the country (e.g., Vashlovani National Park) before and after the core dates (Appendix II: Table 2, Map (Fig. 56), Figs 22–40).

Three Malaise traps were run during a few days around the core dates. In addition, yellow pan, light, pitfall and banana traps were used, as well as Winkler extractors for sifted leaf litter.

In addition to sampling described above, collecting of Heteroptera was done in a variety of habitats, with a focus on brachypterous species of subalpine meadows. So far, two Caucasian endemics have already been identified, one of them just recently described as new to science: *Scirtetellus gudali* Kiritshenko, 1951 and *Myrmecophyes (Plumiger) tomi* Konstantinov & Simov, 2018 (Fig. 54) (both Heteroptera: Miridae).

A quick scan through malaise material collected in Stepantsminda revealed specimens from at least 13 families of lower Diptera. Within the family Mycetophilidae (fungus gnats) the following discoveries are worth mentioning: a big series (14 ♂♂, 11 ♀♀) of *Coelosia flava* (Staeger, 1840), a typical boreo-montane faunal element (Fig. 55) and two females of the widespread but rarely collected species *Grzegorzekia collaris* (Meigen, 1818). Both species records represent the first proof for the Caucasus region.

At least 48 different mollusk species belonging to 24 families were recorded during the core event in Stepantsminda and a short trip from Tbilisi to Kutaisi 1–3 July 2019. Aside from more widespread Western Palearctic species and species occurring also in Anatolia, 16 species endemic to the Caucasus region were recorded. Especially noteworthy are three slug species: the first, *Svanetia*



Figs 18–26. The Greater Caucasus. **18.** Road to Tsana. **19.** Kiosk in Tsana. **20.** Searching for spiders. **21.** Collecting in Tsana, Greater Caucasus (1760 m a.s.l.). **22.** Malaise trap in the garden of Stepantsminda field station. **23.** View from field station to Mount Kazbek (5054 m) and Gergeti Trinity Church. **24.** Gergeti Trinity Church. **25.** View to Stepantsminda from Gergeti Trinity Church. **26.** After field work.

caucasica (Simroth, 1898), is a short-range endemic that is only known from the Kazbegi region and was recorded at the Jvaris Pass. The second is an unidentified species of the genus *Gigantomilax* that was collected north of Gergeti. The genus has previously not been recorded from the Kazbegi region. The third species, *Boettgerilla pallens* Simroth, 1912, is only known from western Georgia, where it was only rarely recorded in the past.

The following Georgian and German researchers attended the Biodiversity Days in Stepantsminda: Cort Anderson (ISU), Ulrich Burkhardt (Senckenberg Museum für Naturkunde Görlitz – Collembola), Marianne Espeland (ZFMK – Trichoptera, Lepidoptera), Matthias Geiger (ZFMK – Fishes, Macrozoobenthos), Nils Hein (Geographisches Institut der Universität Bonn – Arachnida), Kai Heller (GBOL team, independent researcher – Diptera), Bella Japoshvili (ISU – Fishes), Elisabeth Karalashvili (ISU – Arachnida), Thorsten Klug (ZFMK – Myriapoda), Hajo Krammer (ZFMK – Arachnida), Christiane Lange (independent researcher – Diptera), Cornelia Löhne (Uni Bonn – Botany), Peter Manko (University of Presov – aquatic Insects), Dirk Mattern (GBOL team, independent researcher – Trichoptera), Ximo Mengual (ZFMK – Diptera), Carsten Morkel (GBOL team, independent researcher – Heteroptera), Levan Mumladze (ISU), Marco T. Neiber (CeNak Hamburg – Mollusca), André Reimann (GBOL team; Senckenberg Naturhistorische Sammlungen Dresden – Diptera, Scorpiones), Dirk Rohwedder (ZFMK – Hymenoptera), Anke Schäfer (GBOL team; independent researcher – Diptera, Botany), Axel Ssymank (Bundesamt für Naturschutz Bonn – Diptera, Botany), Eckart Stolle (ZFMK – Hymenoptera), Jens-Hermann Stuke (GBOL team, independent researcher – Diptera), David Tarkhnishvili (ISU – herpetology), Jana Thormann (ZFMK – Arthropoda), Karin Voigtländer (Senckenberg Museum für Naturkunde Görlitz – Myriapoda), Benedict Wipfler (ZFMK – Coleoptera), Joachim Ziegler (Museum für Naturkunde Berlin – Diptera).

During the core dates several ISU students joined the researchers: Eka Arsenashvili, Giorgi Bananashvili, Ani Bikashvili, Tinatin Chkhartishvili, Sandro Chubinidze, Giorgi Epitashvili, Giorgi Iankoshvili, Shota Japarashvili, Giorgi Khubashvili, Giorgi Kirtkitadze, Revaz Kvaratskhelia, Natia Rtskhiladze, Nutsa Rtskhiladze, Alisa Sanakoeva, Anano Shubashishvili, Mariam Todua, Ana Tsertsvadze, Mariam Tsulaia and Mariam Zazadze.

According to their field of interest, the students accompanied the scientist during their work in the field and got training in different collecting methods and taxonomic identification.

An additional team of international scientists made an additional expedition one month earlier: Ximo Mengual (ZFMK), Sander Bot (Haren, Netherlands), Jeffrey H. Skevington (Canadian National Collection of Insects, Arachnids and Nematodes, Agriculture and Agri-Food

Canada, Ottawa, Canada), Frank Van de Meutter (Engsbergen, Belgium), Jeroen van Steenis (Naturalis Biodiversity Center, Leiden, Netherlands) and Lenze Hofstee (Haren, Netherlands) collected Diptera in different parts of Georgia 8–23 June 2019.

Furthermore, a joint excursion of students from the Geography department of the University of Bonn (GIUB), the ZFMK and the ISU was held in July/August 2019. This event aimed at teaching knowledge on the underlying mechanisms of the high biodiversity in Georgia to students with different backgrounds.

OUTLOOK

As a continuation of the work in GGBC, we currently plan a Georgian-Armenian-German initiative to establish a joint Caucasus Biodiversity Research Initiative, the Caucasus Barcode of Life Platform (CaBOL). The planned improvements of research and training infrastructure in a long-term international collaboration will provide the latest technology in molecular biodiversity research to Georgian and Armenian scientists and students. A strong initial focus of the project will lie in expanding the DNA barcoding reference databases for Georgia, as initiated within GGBC, and Armenia. CaBOL will collect DNA barcodes, and archive DNA, tissue samples and voucher specimens of Caucasian biodiversity, to the benefit of collections in Georgia, Armenia and Germany. The DNA barcodes and their metadata will be publicly available in a centrally managed database, and will be used for cooperative research projects by Georgian, Armenian and German scientists and students. Simultaneously, CaBOL will equip laboratories in Tbilisi (Georgia) and Yerevan (Armenia), with a strong hub at the Ilia State University, to train students from the South Caucasus region and beyond. Currently, there are no advanced biotechnology facilities available for non-medical research in Georgia and Armenia. Beyond DNA barcoding, infrastructural improvements and its training mission, CaBOL will expand its methodological spectrum by remote sensing approaches and will include experienced forestry partners from the University of Göttingen (Chair of Forest Inventory and Remote Sensing).

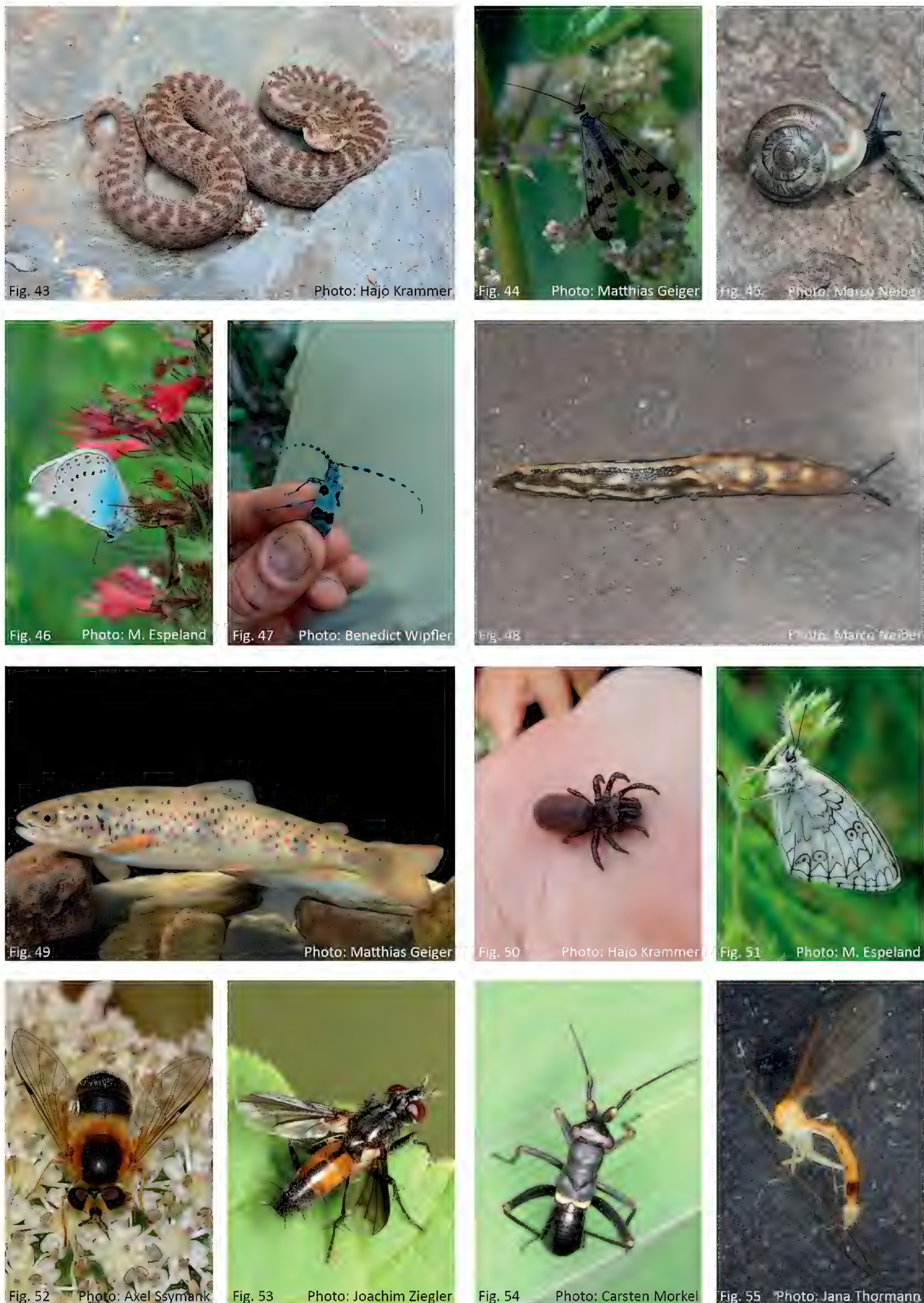
Acknowledgements. The GGBC-project was funded by the German Federal Ministry of Education and Research under grant number 01DK17048. The two field expeditions were supported by Deutsche Gesellschaft für Internationale Zusammenarbeit Georgia under the Integrated Biodiversity Management South Caucasus initiative, funded by the Federal Ministry for Economic Cooperation and Development (contract number 2018: 83291308, contract number 2019: 83322223). Collecting permits were kindly provided by the Agency of Protected Areas of Georgia and the Ministry of Environment Protection and Agriculture of Georgia. ZFMK kindly supported its employees



Figs 27–34. Biodiversity Days 2019. **27.** Analyzing dung samples. **28.** Winkler extractor in repurposed wardrobe. **29.** Daily way to work. **30.** Clearing the road. **31.** ISU students accompany scientists to the field. **32.** Analyzing soil samples in the field. **33.** Sno valley on the way to Juta. **34.** Juta and view to Chaukhi massif.



Figs 35–42. Various collecting sites. **35.** The fishing team. **36.** Truso gorge. **37.** View to Mna valley. **38.** Signaghi and Greater Caucasus in the background. **39.** Collecting on the way to Vashlovani Protected Areas. **40.** Vashlovani Protected Areas. **41.** Lesson in the field during joint excursion with Georgian and German students. **42.** Looking out for birds at Eagle Gorge near Dedoplistsqaro.



Figs 43–55. A snapshot of Caucasian biodiversity. **43.** Squamata: Viperidae, *Vipera dinniki* Nikolsky, 1913. **44.** Mecoptera: Panorpididae, *Panorpa communis* Linnaeus, 1758. **45.** Gastropoda: Hygromiidae, *Caucasigena eichwaldi* (Pfeiffer, 1846). **46.** Lepidoptera: Lycaenidae, *Polyommatus amandus* (Schneider, 1792). **47.** Coleoptera: Cerambycidae, *Rosalia alpina* (Linnaeus, 1758). **48.** Gastropoda: Limacidae, *Eumilax brandti* (Martens, 1880). **49.** Teleostei: Salmonidae, *Salmo ciscaucasicus* Dorofeyeva, 1967. **50.** Araneae: Atypidae, *Atypus muralis* Bertkau, 1890. **51.** Lepidoptera: Nymphalidae, *Melanargia russiae* (Esper, 1783). **52.** Diptera: Syrphidae, *Epistrophe leiophthalma* (Schiner & Egger, 1853). **53.** Diptera: Rhinophoridae, *Stevenia fausti* (Portshinsky, 1875). **54.** Heteroptera: Miridae, *Myrmecophyes tomi* Konstantinov & Simov 2018. **55.** Diptera: Mycetophilidae, *Coelosia flava* (Staeger, 1840).

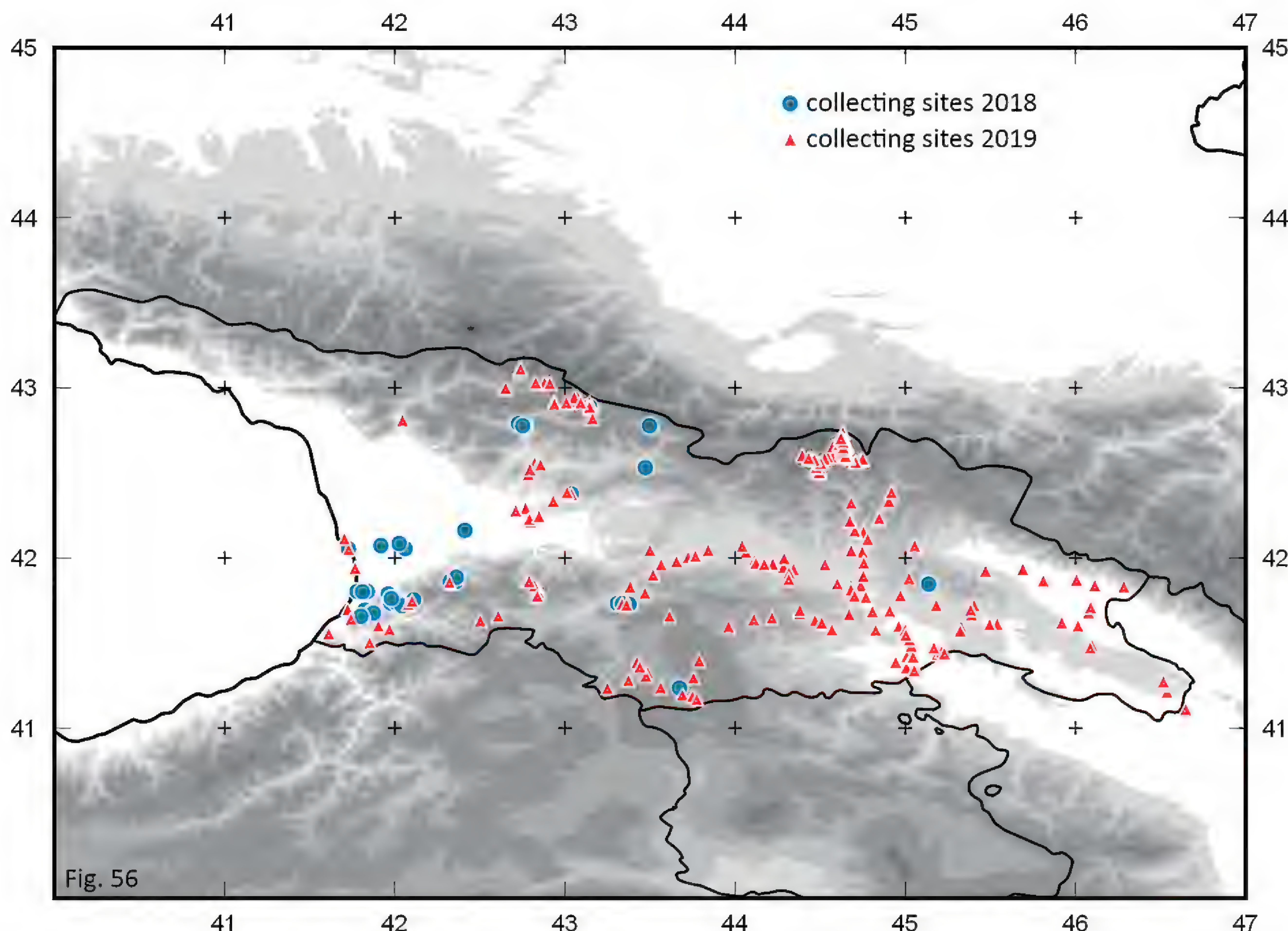


Fig. 56. Map of collecting sites.

with logistics, equipment and travel expenses. We are thankful to all participants of the Biodiversity Days for collecting, identifying and providing specimens for further molecular analysis and thus helping to establish a reference database. We also thank the Georgian students who supervised the Malaise traps in Kintrishi and who are sorting the material.

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APPENDIX II.

Table 1. Collecting sites of 2018, Georgia.

Locality description	Latitude	Longitude	Altitude	Collection date
1 km N of Bakhmaro	41.8576	42.3237	2055 m	19.07.18
Barkhmaro	41.8576	42.3240	2050 m	19.07.18
Black Sea coast near Grigoleti in front of Ilia University field station	42.0535	41.7260		19.07.18
Borjomi, pipeline road between Sakire and Tsikhisjvari, 0.65 km V of Kodiani, meadow and open pine tree forest with large amounts of perennial herbs	41.7271	43.3773	1863 m	22.07.18
Borjomi, pipeline road between Sakire and Tsikhisjvari, 1.75 km W of Kodiani, drier meadow with flowers	41.7323	43.3221	1772 m	23.07.18
Borjomi, pipeline road between Sakire and Tsikhisjvari, 2.3 km E of Sakire, dryish meadow with some wetter areas	41.7325	43.3068	1552 m	22.07.18
Borjomi, pipeline road between Sakire and Tsikhisjvari, 2.9 km E of Kodiani, very diverse meadows	41.7272	43.3771	2190 m	23.07.18
Bugdasheni river, near small Arakali	41.2356	43.6720		01.11.18
Chkhakoura – Bakhmaro road	41.8607	42.3574	1935 m	19.07.18
Chkhakoura – Bakhmaro road, 2.9 km ENE of Bakhmaro, overgrazed meadows	41.8610	42.3569	1900 m	19.07.18
Ghebi	42.7774	43.4956	1410 m	17.07.18
Grassy peak 1 km N of Bakhmaro	41.8611	42.3237	2192 m	19.07.18
Grigoleti, Ilia State Universtity Marine Biological Station	42.0529	41.7272	0 m	18.–20.07.18
Iori River, down from the Paldo Dam	41.8465	45.1357		23.06.18
Khino , entrance	41.7637	41.9788	385 m	27.07.18
Kintrishi	41.7369	41.9839		21.07.18
Kintrishi	41.7520	41.9760	451 m	21.07.18
Kintrishi	41.7880	41.9630		21.07.18
Kintrishi	41.7370	41.9810		21.07.18
Kintrishi drainage: Kintrishi River downstream of old bridge	41.7889	41.9603		21.07.18
Kintrishi drainage: Kintrishi River in Kobuleti Village, upstream of railway bridge	41.8033	41.7778		21.07.18
Kintrishi drainage: Kintrishi River near village Kveda Sameba	41.7991	41.8480		21.07.18

Table 1. Continued.

Locality description	Latitude	Longitude	Altitude	Collection date
Kintrishi drainage: Kintrishi River SE of Khutsubani Village	41.8029	41.8384		20.07.18
Kintrishi drainage: Kintrishi River, upstream of gravel quarry E of Kobuleti	41.8016	41.8095		22.07.18
Kintrishi National Park, at bisection behind ranger station; under bark and dead wood relatively close to the river; humid leaf litter	41.7303	41.9817	450 m	20.07.18
Kintrishi Nature Reserve	41.7345	41.9888	460 m	18.07.18
Kintrishi Nature Reserve, Khino	41.7380	42.0076	595 m	18.07.18
Kintrishi Nature Reserve, Khino	41.7345	41.9888	980 m	20.07.18
Kintrishi NR	41.7369	41.9839	450 m	29.07.18
Kintrishi NR, Khino monastery	41.7286	42.0781		29.07.18
Kintrishi NR, picnic spot	41.7319	41.9753	570 m	21.07.18
Kintrishi Protected Areas	41.7621	41.9785	318 m	19.07.18
Kintrishi Protected Areas	41.7366	41.9787	415 m	19.07.18
Kintrishi Protected Areas	41.7349	41.9710	400 m	19.07.18
Kintrishi Protected Areas, Didvake	41.7463	42.0167	1102 m	18.07.18
Kintrishi Protected Areas, Didvake Village	41.7172	42.0467	800 m	17.07.18
Kintrishi Protected Areas, monastery at Khino, meadows	41.7287	42.0782	906 m	20.07.18
Kintrishi Protected Areas, monastery at Khino, meadows, meadow – pine forest mosaic	42.7752	42.7608	1370 m	25.07.18
Kintrishi River, side valley	41.7346	41.9758	670 m	19.07.18
Kintrishi, Khino	41.7287	42.0782	980 m	21.07.18
Kintrishi, National Park	41.7440	42.0832	1280 m	21.07.18
Kintrishi-National Park, woods and meadows around Khino Monastery	41.7169	42.0552		23.07.18
Kintrishi-National Park, wayside between Didvake and Khino along Kintrishi River	41.7173	42.0469	790 m	18.07.18
Near Lentekhi, antennae	42.7774	42.7502	1405 m	25.07.18
North from Atsana, along the road	42.0559	42.0594	275 m	19.07.18
Above Khino Church	41.7283	42.0841	1028 m	23.07.18
Above Khino Church, second meadow	41.7344	42.0845	1089 m	20.07.18
Paliastomi-Rioni drainage: Oragvisghele Stream SW of Lanchkhuti Village	42.0850	42.0246	–	19.07.18
Paliastomi-Rioni drainage: Swlana Stream S of Jurukveti Village, upstream of 02-18	42.0654	41.9209	–	24.07.18
Paliastomi-Rioni drainage: Swlana Stream W of Jurukveti Village	42.0783	41.9164	–	19.07.18
Paliastomi-Rioni drainage: Swlana Stream W of Jurukveti Village, upstream of 02-18	42.0730	41.9168	–	24.07.18
Rioni drainage: Gubistskali River E of Samtredia Town, above confluence with Rioni River and Rioni Channel	42.1625	42.4107	–	24.07.18
Road from Sakire to Tsikhisjvari	41.7303	43.3348	1910 m	22.07.18
Road from Sakire to Tsikhisjvari	41.7271	43.3773	2185 m	22.07.18
Road from Sakire to Tsikhisjvari	41.7326	43.3081	1600 m	22.07.18
Road to Barkhamro	41.8609	42.3572	1935 m	19.07.18
Road to Barkhamro	41.8863	42.3614	1645 m	19.07.18
Road to Chkhakoura - Bakhmaro road, 5 km NE of Bakhmaro, meadows on ridge along road	41.8863	42.3612	1660 m	19.07.18
Road to Khino, Kintrishi Protected Areas, 6 km WNW of monastery at Khino, sunny, exposed rock face along road	41.7376	42.0074	638 m	18.07.18
Road to Tsana	42.8739	43.1500	1600 m	24.07.18
Samtskhe-Javakheti, road from Sakire to Tsikhisjvari	41.7303	43.3348	1900 m	23.07.18
Tsana	42.8889	43.1430	1760 m	24.07.18
Tskhmori, Chalistskali Waterfall	42.5313	43.4709	1225 m	18.07.18
Below Khino, meadow	41.7195	42.0408	840 m	18.07.18
Western Meskheta Mountains	41.7553	42.1112	2280 m	09.08.18

Table 1. Continued.

Locality description	Latitude	41.9782	Altitude	Collection date
Malaise Trap, ranger station Kintrishi	41.7621	41.9785	318 m	Apr.–Nov. 2018
Malaise Trap Grigoleti field station	42.0528	41.7269	7 m	17.–25.04.18
Malaise Trap Transect Kintrishi #1	41.7294	42.0776	1035 m	20.04.– 05.11.2018
Malaise Trap Transect Kintrishi #2	41.7294	42.0775	1020 m	20.04.– 05.11.2018
Malaise Trap Transect Kintrishi #3	41.7296	42.0773	1031 m	20.04.– 05.11.2018
Malaise Trap Transect Kintrishi #4	41.7441	42.0834	1264 m	20.04.– 05.11.2018
Malaise Trap Transect Kintrishi #5	41.7434	42.0818	1252 m	20.04.– 05.11.2018
Malaise Trap Transect Kintrishi #6	41.7433	42.0841	1235 m	20.04.- 05.11.2018
Malaise Trap Transect Kintrishi #7	41.7371	41.9792	404 m	20.04.- 05.11.2018
Malaise Trap Transect Kintrishi #8	41.7378	41.9786	403 m	20.04.- 05.11.2018
Malaise Trap Transect Kintrishi #9	41.7378	41.9782	401 m	20.04.– 05.11.2018
Malaise Trap Transect Kintrishi #10	41.7479	42.0959	1697 m	24.04.– 05.10.2018
Malaise Trap Transect Kintrishi #11	41.7477	42.0951	1637 m	24.04.– 05.10.2018
Malaise Trap Transect Kintrishi #12	41.7482	42.0940	1634 m	24.04.– 05.10.2018
Malaise Trap Transect Kintrishi #13	41.7552	42.1125	2268 m	24.04.– 05.10.2018
Malaise Trap Transect Kintrishi #14	41.7553	42.1128	2280 m	24.04– 05.10.2018
Malaise Trap Transect Kintrishi #15	41.7554	42.1129	2280 m	24.04.– 05.10.2018
Malaise Trap Transect Kintrishi #16	41.7625	42.1157	2465 m	24.04.– 05.10.2018
Malaise Trap Transect Kintrishi #17	41.7619	42.1162	2462 m	24.04.– 05.10.2018
Malaise Trap Transect Kintrishi #18	41.7616	42.1158	2450 m	24.04.– 05.10.2018

APPENDIX II.

Table 2. Collecting sites of 2019, Georgia.

Locality description	Latitude	Longitude	Altitude	Collection date
1.4 km WSW Ilmazlo	41.4240	45.0080	—	30.06.2019
10 km S. of Kasristskali, Vashlovani NR	41.2235	46.5353	390 m	10.07.2019
14 km E of Mestia	43.0254	42.8907	2550 m	13.06.2019
14.5 km E of Mestia, forest with <i>Rhododendron</i>	43.0284	42.8788	2345 m	13.06.2019
15 km E of Mestia	43.0266	42.9101	2860 m	13.06.2019
2 lakes between Amali River and Terek	42.7219	44.6225	1538 m	09.07.2019
2.8 km nnw Jikurebi Lake	41.5980	45.3260	—	01.07.2019
20 km S of Stepandsminda	42.5105	44.4949	2550 m	1.–7.7.2019
5 km W of Naduknari	42.0640	45.0636	1045 m	08.07.2019
7 km W of Ushguli, along the road	42.9179	42.9366	2290 m	16.06.2019
7 km W of Ushguli, hilltop	42.9062	42.9370	2615 m	16.06.2019
7.5 km N of Mestia, path to glacier	43.1017	42.7276	1850 m	14.06.2019
7.5 km N of Mestia, path to glacier	43.1133	42.7379	1800 m	14.06.2019
7.7 km NE Mele, meadow	42.8211	43.1607	1450 m	20.06.2019
Abastumani area, along path	41.8234	42.8400	2025 m	11.06.2019
Akavreta river, left tributary of Adjaristskali River	41.5821	41.9679	—	01.06.2019
Akhaldaba northeast of Borjomi, Nedzvi Sanctuary	41.9028	43.5167	890 m	15.07.2019
Akhaltsikhe, Snotskali River valley	42.5881	44.6667	1802 m	10.07.2019
Akhaltsikhe-Sno, Snotskali River valley	42.5997	44.6528	1780 m	10.07.2019
Aktas Golu	41.2360	43.2490	—	11.07.2019
Alazani Chanal, near Tibaani	41.6016	46.0139	—	22.05.2019
Alazani River, down from the Shilda	41.9351	45.6891	—	25.07.2019
Alazani River, tributary of Kabali – Alazani, Tsnori bridge	41.6807	46.0756	—	22.05.2019
Algeti River 0.8 km WNW Tskhrakudaani	41.6750	44.3790	—	10.07.2019
Algeti River 3.4 km NW Abrameti	41.6340	44.4690	—	13.07.2019
Algeti River N Partskhisi	41.5790	44.5670	—	13.07.2019
Almasiani, southern end of village	42.5544	44.4969	1990 m	07.07.2019
Along Khde River above Dariali Monastery complex, 10 km N of Stepanzminda; Kazbegi Municipality	42.7360	44.6341	1350 m	02.07.2019; 06.07.2019
Along path to Gveleti big waterfalls, rich, variable meadows, scree; Kazbegi Municipality	42.7053	44.6149	1450–1700 m	02.07.2019; 06.07.2019
Alpana towards Kutaisi, Rioni Valley, limestone cliff along road	42.5581	42.8206	380 m	02.07.2019
Alpana towards Kutaisi, Rioni Valley, right side, north of Mekvena	42.4914	42.7839	370 m	02.07.2019
Alpana towards Kutaisi, Rioni Valley, southern entrance of canyon-like part of valley	42.5219	42.7942	380 m	02.07.2019
Alpana, limestone cliffs on left side of Rioni Valley	42.5592	42.8486	420 m	02.07.2019
Ananuri towards Zhinvali Dam, ca 4.5 km along road north of the dam	42.1525	44.7531	940 m	03.07.2019
Ananuri, slope opposite monastery, beyond bridge	42.1606	44.7028	880 m	03.07.2019
Aragvi River NE Zhinvali	42.1120	44.7780	—	07.07.2019
Aragvi River W Bulachauri	42.0360	44.7460	—	07.07.2019
Aragvi River W Choporti	41.9730	44.7560	—	07.07.2019
Aragvi Valley, between junction towards Dgnali and Tsivtskaro	42.2175	44.6728	910 m	07.07.2019
Aragvi Valley, Bibiliani, southern end of village	42.3244	44.6814	1050 m	07.07.2019
Bakhmaro	41.8600	42.3200	2000 m	03.08.2019
Batumi, Botanical Garden	41.6990	41.7220	—	19.07.2019

Table 2. Continued.

Locality description	Latitude	Longitude	Altitude	Collection date
Mountain station at Kobi	42.5112	44.4929	2957 m	07.07.2019
Between Kanobi and Pkhelshe along river Kesia	42.5980	44.5410	—	07.07.2019
Between Kvishkheti and Khashuri	41.9625	43.5636	740 m	08.06.2019
Between Tianeti and Akhmeta	42.0640	45.0640	1000 m	08.07.2019
Between Tskneti and Kojori	41.6700	44.6690	—	15.07.2019
Blashoviskhevi River SW Norio	41.7800	44.9700	—	02.07.2019
Borjomi	41.8320	43.3820	—	28.07.2019
Bridge on road to Gveleti waterfalls, fast-flowing, rocky stream with a lot of vegetation around	42.7074	44.6247	1493 m	02.07.2019; 06.07.2019
Bughdasheni Lake	41.1980	43.6890	—	12.07.2019
Bursa Stream, tributary to Alasani River about 3 km S of Sanavardo	41.8670	45.8100	—	08.07.2019
Chargali, Pschawi-Aragwi	42.3342	44.9031	1029 m	05.07.2019
Charnali, Sarpi	41.5560	41.6110	—	19.07.2019
Chili-Chili River in Beshtasheni	41.6410	44.1090	—	13.07.2019
Chkheri River, Stepanzminda	42.6712	44.6123	2000 m	02.–03.07.2019
Chkheri Valley northwest of Stepanzminda	42.6708	44.6170	1960 m	05.07.2019
Chkheri Valley, right side	42.6706	44.6097	2030 m	04.07.2019
Chrami River N Tikilisa	41.5970	43.9600	—	13.07.2019
Cow and horse pasture W of Stepandsminda	42.6668	44.6303	1812 m	1.–7.7.2019
Daliari Valley	42.7371	44.6318	1319 m	08.07.2019
Dariali gorge	42.7030	44.6270	—	05.07.2019
Dariali Gorge, surroundings of the monastery complex of the Holy Archangels Michael and Gabriel	42.7362	44.6333	1340 m	
Debeda River E Kirach-Mughanlo	41.3340	45.0680	—	30.06.2019
Debeda River N Khanji-Gazlo	41.3570	45.0050	—	30.06.2019
Debeda River N Kirach-Mughanlo	41.3400	45.0510	—	30.06.2019
Debeda River W Didi Mughanlo	41.3890	44.9430	—	30.06.2019
Dedoplistskharo, road to Eagle Canyon, very dry meadow dominated by <i>Eryngium</i>	41.4875	46.0944	770 m	10.07.2019
Enguri Dam	42.8100	42.0450	—	04.08.2019
Entrance Vashlovani Nationalpark	41.2143	46.5368	380 m	10.07.2019
Fluvial plane Tergi = Terek	42.6532	44.6356	1733 m	04.07.2019
Forest	42.0644	45.0635	1059 m	08.07.2019
Former road, tunnel	42.6900	44.6357	1633 m	08.07.2019
Gelati Monastery, walls and stones along path on the southside of the monastery	42.2939	42.7683	420 m	01.07.2019
Gergeti Sameba, valley west of church	42.6628	44.6106	2150 m	04.07.2019
Gergeti, close to road to Gergeti Trinity Church	42.6669	44.6128	2175 m	13.07.2019
Gergeti, Ghkheri Valley	42.6700	44.6103	2103 m	13.07.2019
Gergeti, Ghkheri Valley	42.6708	44.6119	1900 m	18.07.2019
Gergeti, north of village	42.6669	44.6303	1830 m	04.07.2019
Gergeti, road to Gergeti Trinity Church	42.6720	44.6100	—	04.07.2019
Gergeti, valley S of Gergeti Trinity Church	42.6617	44.6156	2080 m	13.07.2019
Gergeti Trinity Church parking spot	42.6650	44.6143	2257 m	1.–7.7.2019
Goderdzi Pass	41.6330	42.5010	—	20.07.2019
Goderdzi Pass	41.6610	42.6070	—	19.07.2019

Table 2. Continued.

Locality description	Latitude	Longitude	Altitude	Collection date
Gori Castle, southern side of castle hill	41.9856	44.1086	620 m	03.07.2019
Gori, Stalin Park	41.9867	44.1136	600 m	03.07.2019
Grigoleti	42.0530	41.7280	—	28.07.— 03.08.2019
Group of trees near Vashlovani NP	41.2524	46.5188	465 m	10.07.2019
Gudauri, lift station	42.5105	44.4954	3000 m	07.07.2019
Gudauri Pass, at Tufa formations	42.5336	44.4750	2210–2230 m	11.07.2019
Gveleti	42.7071	44.6254	1500 m	04.07.2019
Gveleti	42.7215	44.6225	1900 m	09.07.2019
Gveleti Lakes, Kazbegi Municipality	42.7227	44.6238	—	
Gveleti north of Stepanzminda slopes near the Great waterfall	42.7047	44.6184	1620 m	04.07.2019; 07.07.2019
Gveleti north of Stepanzminda valley below the waterfalls	42.7061	44.6224	1520 m	03.07.2019; 07.07.2019
Gveleti Waterfalls	42.7044	44.6205	—	1.–7.7.2019
Gveleti Waterfalls	42.7070	44.6252	1483 m	04.07.2019
Gveleti Waterfalls	42.7078	44.6253	1478 m	12.07.2019
Gveleti, near small waterfall	42.7025	44.6194	1645 m	17.07.2019
Gveleti, small waterfall	42.7050	44.6150	1600 m	06.07.2019
Gveleti, way to waterfall	42.7060	44.6170	1700 m	06.07.2019
Gveleti Valley	42.7074	44.6247	1485 m	02.07.2019
Heretiskari, way to Signaghi	41.7110	46.0870	200 m	09.07.2019
Iori River 8.5 km SE Sagaredscho	41.6680	45.3880	—	01.07.2019
Iori River N Qaracop	41.6130	45.5390	—	01.07.2019
Iori River NE Sartichala	41.7230	45.1810	—	01.07.2019
Jandara Reservoir 1.6 km SE Jandari	41.4350	45.1870	—	02.07.2019
Jandara Reservoir 2.8 km SE Mzianeti	41.4510	45.2120	—	02.07.2019
Jandara Reservoir 4.7 km SE Mzianeti	41.4400	45.2280	—	02.07.2019
Junction of Kora River valley and Juta Valley, valley bottom, rich in succulents; Kazbegi Municipality	42.5627	44.7070	1830 m	05.07.2019
Juta	42.5720	44.7310	—	05.07.2019
Juta	42.5797	44.7431	2160 m	05.07.2019
Juta at Sno-Valley, village	42.5795	44.7459	—	05.07.2019
Juta Valley, Juta mountainside with rich meadows; Kazbegi Municipality	42.5800	44.7423	2100–2200 m	05.07.2019
Juta, brook above the village	42.5839	44.7486	2185 m	10.07.2019
Juta, slope	42.5796	44.7436	2148 m	09.07.2019
Juta, village border	42.5794	44.7433	2150 m	10.07.2019
Jutistskali River	42.5838	44.7484	2182 m	10.07.2019
Jutistskali Valley, right side, near confluence with Kora River	42.5622	44.7061	1860 m	05.07.2019
Jvari Monastery, along road east of the monastery	41.8403	44.7367	600 m	01.07.2019
Jvari Pass	42.5189	44.4669	2360 m	07.07.2019
Kapatadze Lake	41.5730	45.3220	—	01.07.2019
Kasbek Mountains 5.6 km W Stepanzminda	42.6590	44.5760	—	05.07.2019
Keda, Kveda Agara	41.6020	41.9020	—	19.07.2019
Khde-riverbed above Dariali-Monastery-complex	42.7360	44.6342	1360 m	02.07.2019
Khino, Kintrishi	41.7290	42.0780	—	30.–31.07.2019

Table 2. Continued.

Locality description	Latitude	Longitude	Altitude	Collection date
Khomisdziri, Pschawi-Aragwi	42.3880	44.9185	1070 m	05.07.2019
Khornabuji	41.4724	46.0847	780 m	10.07.2019
Khurtisi, meadows with tall-herbs and mountainside with shorter vegetation; Kazbegi Municipality	42.5994	44.5444	1980–2200 m	07.07.2019
Kintrishi	41.7490	42.1000	–	31.07.2019
Kirkhbulaki River e Qulalisi	41.3270	43.4840	–	11.07.2019
Kobi, near Kobi Pass	42.4983	44.4931	2760 m	14.07.2019
Kobi, near Kobi Pass	42.5047	44.4931	2860 m	14.07.2019
Kobi, near ski lift base station	42.5572	44.4975	1825 m	14.07.2019
Kobi Valley/ river Tergi= Terek	42.5809	44.4642	2009 m	07.07.2019
Kochki River S Epremovka	41.1890	43.7480	–	12.07.2019
Korolistavi, Mtirala	41.6420	41.7430	–	18.07.2019
Ksani river, near Mukhrani Village	41.9628	44.5265	–	30.06.2019
Kumisi Lake, S of Tbilisi	41.5770	44.8240	–	16.07.2019
Kura drainage: Aragvi River near Naoza	41.9720	44.7550	–	07.07.2019
Kura drainage: Pshavis Aragvi River near Tsiprani Village, upstream of Zhinvali reservoir	42.2340	44.8450	–	05.07.2019
Kura drainage: small unnamed tributary stream to Pshavis Aragvi River about 5 km N of Chargali village	42.3870	44.9180	–	05.07.2019
Kura River 1.2 km Nn Metekhi	41.9340	44.3420	–	09.07.2019
Kura River 1.3 km NNW Tedotsminda	42.0350	44.0620	–	08.07.2019
Kura River 1.5 km W Khtsisi	41.9800	43.6550	–	08.07.2019
Kura River 1.6 km E Ilmazo	41.4280	45.0430	–	30.06.2019
Kura River 1.9 km ESE Ilmazo	41.4180	45.0420	–	30.06.2019
Kura River 2 km S Karajalari	41.5990	44.9600	–	29.06.2019
Kura River 2.0 km ESE Ilmazo	41.4200	45.0440	–	30.06.2019
Kura River 2.3 km NNE Teliani	41.9480	44.2820	–	09.07.2019
Kura River 2.3 km W Mtskheta	41.8390	44.6800	–	07.07.2019
Kura River 6.6 km E Khidistavi	41.9600	44.2100	–	09.07.2019
Kura River 7.5 km E Khidistavi	41.9650	44.2200	–	09.07.2019
Kura River E Variani	42.0730	44.0400	–	08.07.2019
Kura River N Akhalsheni	42.0050	43.7230	–	08.07.2019
Kura River NW Akhalsopeli	42.0130	43.7650	–	08.07.2019
Kura River NW Dzegvi	41.8500	44.5990	–	07.07.2019
Kura River SE Gachiani	41.5780	44.9990	–	29.06.2019
Kura River SE Gori	41.9710	44.1210	–	09.07.2019
Kura River, Rustawi	41.5510	45.0100	–	29.06.2019
Kura valley 2.3 km W Akhalsheni	41.4870	45.0380	–	29.06.2019
Kura valley 2.7 km W Akhalsheni	41.4840	45.0340	–	29.06.2019
Kura valley SE Rustawi	41.5200	45.0230	–	29.06.2019
Kutaisi, Bagrati Cathedral	42.2775	42.7050	210 m	02.07.2019
Kutaisi, Botanical Garden	42.2792	42.7097	160 m	01.07.2019
Kveda Chkhutuneti	41.5020	41.8510	–	19.07.2019
lakes 3.4 km N Tsdo	42.7160	44.6240	–	03.07.2019
Mariini Canal 3.4 km N Jandari	41.4730	45.1670	–	02.07.2019

Table 2. Continued.

Locality description	Latitude	Longitude	Altitude	Collection date
Meadows with basaltic rocks; Kazbegi Municipality	42.5797	44.4700	2000–2300 m	07.07.2019
Mineral Springs, Baidara Valley north of Jvari Pass	42.5319	44.4722	2250 m	05.07.2019
Middle station, Kobi	42.5317	44.4934	2513 m	07.07.2019
Mna-Valley, W of Shevardeni	42.5800	44.4700	–	07.07.2019
Monastery Church	42.6648	44.6148	2169 m	03.07.2019
Monestry N of Stepandsminda	42.7362	44.6330	1899 m	1.–7.7.2019
Mountain pasture at road between Achmeta and Tianeti	42.0635	45.0641	1030 m	08.07.2019
Nadarbazevis Tba	41.9990	44.2870	–	10.07.2019
Nakerala Pass	42.3758	43.0372	1230 m	02.07.2019
Nakhshirgele towards Kutaisi, ca 200 m east of bridge over Tchishura River	42.2150	42.7983	130 m	01.07.2019
Nakhshirgele towards Kutaisi, ca 500 m along road to Broloskedi	42.2300	42.7908	150 m	01.07.2019
Narvani River, Kobi	42.5616	44.5102	1959 m	04.07.2019
Navenakhevi, forest near Navenakhevi Cave	42.2461	42.8469	300 m	02.07.2019
Near to Lagodechi NP	41.8335	46.2825	550 m	09.07.2019
Near Tsana, along the road	42.8887	43.1429	1757 m	18.06.2019
Near Tsana, along the road	42.9012	43.1422	1835 m	18.06.2019
Near Tsana, along the road	42.9160	43.1428	1975 m	19.06.2019
Near Tsana, meadow	42.8889	43.1430	1760 m	18.06.2019
Near Ushguli, close to river Inguri	42.9499	43.0719	2270 m	15.06.2019
Near Ushguli, path to glacier	42.9437	43.0539	2220 m	15.–17.06.2019
Near Ushguli, up to the ruins	42.9101	43.0070	2295 m	17.06.2019
Near Vashlovani NP	41.2636	46.5261	–	10.07.2019
NW of Stepanzminda	42.6710	44.6100	2050 m	04.07.2019
NW of Stepanzminda	42.6740	44.6330	2200 m	01.–07.07.2019
On the way to Sighnaghi, village Heretiskari, oak grove	41.7106	46.0870	215 m	–
on the way to Telawi	42.0605	45.0617	1555 m	–
E of Sno, alluvial forest	42.5996	44.6531	1781 m	10.07.2019
Ozero Zres	41.3880	43.4230	–	11.07.2019
Pass from Ushguli to Tsana	42.9140	43.0911	2575 m	18.06.2019
Pastures 1 km E Stepanzminda	42.6580	44.6600	–	06.07.2019
Pastures around Gergeti Trinity Church	42.6650	44.6150	–	06.07.2019
Path from Chkheri riverbed to road to Gergeti Trinity Church	42.6694	44.6119	2000– 2103 m	04.07.2019
Plain at Akhaltsikhe	42.5889	44.6657	1802 m	09.07.2019
Poti, Paliastomi Lake	42.1150	41.7030	–	29.07.2019
Rioni Valley, ca 1 km along road towards Ambrolauri	42.5489	42.8558	440 m	02.07.2019
Riverbed at Terek between Achkhota and Stepanzminda	42.6359	44.6285	1755 m	05.07.2019
Riverside W of Stepandsminda	42.6707	44.6097	2044 m	1.–7.7.2019
Road between Tianeti and Akhmeta, near road to Vedzebi, grassy meadow with some flowers, surrounded by mixed beech forest	42.0739	45.0536	1100 m	08.07.2019
Road from Abastumani to Sairme	41.7963	42.8444	1700 m	10.06.2019; 11.06.2019
Road from Abastumani to Sairme	41.7969	42.8439	1725 m	10.–11.06.2019
Road from Abastumani to Sairme	41.8385	42.8194	2260 m	10.06.2019
Road from Abastumani to Sairme	41.8643	42.7784	1830 m	10.06.2019; 11.06.2019

Table 2. Continued.

Locality description	Latitude	Longitude	Altitude	Collection date
Road from Abastumani to Sairme, near river	41.7773	42.8372	1386 m	10.–11.06.2019
Road from Abastumani to Sairme, small creek	41.8638	42.7890	1800 m	11.06.2019
Road from Sakire to Tsikhisjvari	41.7305	43.3343	1900 m	09.06.2019
Road from Sakire to Tsikhisjvari, hilltop and surroundings	41.7250	43.3606	2519 m	–
Road to Gergeti Trinity Church	42.6670	44.6140	2100 m	01.–07.07.2019
Road to Gergeti Trinity Church	42.6730	44.6160	2250 m	01.–07.07.2019
Road to Vashlovani National Park, 7km NW of gate, dry steppe	41.2742	46.5146	450 m	10.07.2019
Rustawi, lake close to Kura River	41.5490	45.0020	–	29.06.2019
S of Lakhushdi, meadow	42.9988	42.6501	1270 m	13.–14.06.2019
S of Lakhushdi, meadow	42.9990	42.6502	1270 m	13.–14.06.2019
S of Sioni	42.5960	44.5700	1900 m	07.07.2019
S of Stepanzminda	42.6370	44.6310	–	05.07.2019
Saguramo	41.8944	44.7521	551 m	21.06.2019
Satsire, southern outskirts of village	42.3350	42.9300	560 m	02.07.2019
Scrub and undergrowth near Sighnaghi	41.6128	45.9329	660 m	–
Sheep and horse pasture	42.6504	44.6514	1861 m	1.–7.7.2019
Shevardini > Truso Gorge	42.5914	44.4378	2100 m	15.07.2019
Shevardini > Truso Gorge, near Tufa formations	42.5828	44.4303	2132 m	15.07.2019
Side valley (Kora River) of Sno Valley	42.5637	44.7074	1845 m	05.07.2019
Sighnaghi	41.6210	45.9180	–	09.07.2019
Sighnaghi, surroundings of “Best Host”	41.6213	45.9180	727 m	10.–11.07.2019
Sioni	42.5963	44.5702	2000 m	07.07.2019
Slope at Chkheri riverbed near Gergeti Trinity Church	42.6722	44.6114	2070 m	04.07.2019
Small lake 2.0 km ENE Patara Gondra	41.3070	43.4750	–	11.07.2019
Small lake 2.2 km ENE Imera	41.6500	44.2150	–	10.07.2019
Small lake N Sulda	41.2820	43.3720	–	11.07.2019
Small oakwood	41.7102	46.0876	229 m	10.07.2019
Small river 1.6 km WSW Tokhliauri	41.7210	45.4030	–	01.07.2019
Small river valley SW Manglisi	41.6940	44.3790	–	10.07.2019
Small valley 1.1 km NE Abrameti	41.6200	44.5080	–	13.07.2019
Small valley 4.8 km SE Giorgitsminda	41.6960	45.3830	–	01.07.2019
Small valley near Kanobi at Kesia River	42.5975	44.5406	1925 m	07.07.2019
Sno, Snotskali River valley	42.5989	44.6500	1780 m	11.07.2019
Snotskali River 0.6 km NW Sno	42.6090	44.6330	–	04.07.2019
Snotskali River 0.6 km SE Achkhoti	42.6180	44.6240	–	03.07.2019
Snotskali River 0.8 km SE Sno	42.6000	44.6450	–	04.07.2019
Snotskali River SE Akhaltsikhe	42.5880	44.6670	–	04.07.2019
Soramula River 1.7 km ENE Agara	42.0470	43.8410	–	08.07.2019
Stepantsminda, station of Ilia State University	42.6550	44.6492	1830 m	04.07.2019
Stepanzminda	42.6530	44.6550	1800 m	02.07.2019
Stepanzminda	42.6535	44.6496	1823 m	03.–06.07.2019
Stepanzminda	42.6549	44.6495	1900 m	1.–7.7.2019
Stepanzminda	42.6581	44.6566	1900 m	06.07.2019
Stepanzminda	42.6641	44.6144	2163 m	07.07.2019
Stepanzminda	42.6656	44.6365	1797 m	03.07.2019

Table 2. Continued.

Locality description	Latitude	Longitude	Altitude	Collection date
Stepanzminda	42.6704	44.6096	2034 m	03.07.2019
Stepanzminda, along road to Ioane Natismcemeli Orthodox Church, overgrazed meadows with <i>Hippophae rhamnoides</i> ; Kazbegi Municipality	42.6523	44.6538	1860 m	2.07.2019.
Stepanzminda, cow and horse pasture W of Stepandsminda	42.6678	44.6316	1810 m	–
Stepanzminda, Elm Monastery	42.6575	44.6567	1950 m	17.07.2019
Stepanzminda, Gveleti	42.7161	44.6239	1400 m	09.07.2019
Stepanzminda, Gveleti, Tibistskali River	42.7047	44.6208	1540 m	12.07.2019
Stepanzminda, Gveleti, Tibistskali River	42.7078	44.6253	1480 m	12.07.2019
Stepanzminda, hilltop north of Gergeti Trinity Church	42.6753	44.6158	2250 m	–
Stepanzminda, Ilia State University field station	42.6548	44.6490	1820 m	12.07.2019
Stepanzminda, Kasbek mountain	42.6667	44.6008	2470 m	18.07.2019
Stepanzminda, near Snotskali River mouth	42.6367	44.6308	1750 m	16.07.2019
Stepanzminda, near village	42.6628	44.6394	1745 m	16.07.2019
Stepanzminda, parking bay on the way to the Gergeti Trinity Church	42.6669	44.6136	2120 m	–
Stepanzminda, pass to Gergeti Glacier	42.6588	44.5736	2900 m	05.07.2019
Stepanzminda, road to Gergeti Trinity Church	42.6678	44.6106	2160 m	18.07.2019
Stepanzminda, slope opposite pastures	42.6672	44.6292	1825 m	–
Stepanzminda, Snotskali River mouth	42.6369	44.6325	1760 m	16.07.2019
Stepanzminda, steep mountainside, flower-rich with some drier areas, flower-rich meadow on top; Kazbegi Municipality	42.6755	44.6130	1980–2400 m	04.07.2019
Stepanzminda, Tergi River	42.6519	44.6392	1740 m	15.07.2019
Stepanzminda, way to hilltop north of Gergeti Trinity Church	42.6725	44.6161	1900–2250 m	–
Streamcourse	42.6711	44.6118	1996 m	09.07.2019
Streamcourse to monastery	42.6706	44.6096	2023 m	09.07.2019
Street to Baisubani	41.8399	46.1121	300 m	09.07.2019
Sulfur springs at Dschari Pass	42.5346	44.4756	2216 m	11.07.2019
Surami Pass, eastern side	42.0472	43.4981	910 m	03.07.2019
Tabatskuri	41.6600	43.6130	–	23.07.2019
Coombe, river Tegi= Terek	42.6843	44.6362	1594 m	08.07.2019
Valley station, Kobi	42.5573	44.4976	1988 m	07.07.2019
Tba Bazalet'i	42.0440	44.6810	–	07.07.2019
Tba Khanjali	41.2390	43.5610	–	10.07.2019
Tba Mada	41.1710	43.7730	–	12.07.2019
Tba Paravani	41.3980	43.7870	–	13.07.2019
Tba Saghamo	41.2970	43.7540	–	12.07.2019
Tbilisi National Park	41.8808	45.0204	1270 m	22.06.2019
Tbilisi, Botanical Garden	41.6872	44.8056	470 m	07.07.2019
Tbilisi, Chilitba Lake	41.8150	44.6800	–	25.05.2019
Tbilisi, Dighomi	41.7780	44.7010	–	17.07.2019
Tbilisi, Dighomi, next to cemetery	41.7710	44.7670	–	17.07.2019
Tbilisi, Kakheti Highway/Aleksandre Tvalchrelidze I Turn, hotel garden	41.6892	44.9078	480 m	07.07.2019
Tedzami River 1.4 km NE Zemo Khandaki	41.9130	44.3160	–	09.07.2019
Tedzami River, tributary to Kura river, near Ertatsminda Village	41.8760	44.3144	–	30.06.2019
Telawi, Guest House LeNi	41.9152	45.4719	760 m	08.07.2019
Telawi, surroundings of hostel	41.9241	45.4701	685 m	08.07.2019

Table 2. Continued.

Locality description	Latitude	Longitude	Altitude	Collection date
Teliangkhevi River W Paldo	41.6110	45.4940	—	01.07.2019
Terek drainage: Narvani River at Kobi Village close to confluence with Terek River	42.5612	44.5093	—	04.07.2019
Terek drainage: Snostskali River near Akhaltsikhe Village	42.5940	44.6600	—	06.07.2019
Terek drainage: Snostskali River SE of Sno Village, small side channel of main channelized river	42.6003	44.6469	—	02.07.2019
Terek River 0.4 km W Pansheti	42.6350	44.6240	—	03.07.2019
Terek River 0.5 km S Kanobi	42.5850	44.5240	—	04.07.2019
Terek River 1.0 km WSW Stepanzminda	42.6530	44.6350	—	03.07.2019
Terek River 1.3 km SW Stepanzminda	42.6490	44.6340	—	03.07.2019
Terek River 1.6 km W Ukhati	42.5580	44.5020	—	04.07.2019
Terek Valley near confluence with Khde River, north of Dariali Monastery	42.7369	44.6314	1300 m	06.07.2019
Terek Valley, Darial Gorge, east of Tsdo	42.6936	44.6414	1560 m	05.07.2019
Terek Valley, Darial Gorge, near Gveleti	42.7036	44.6269	1480 m	05.07.2019
Terek Valley, Darial Gorge, south of Gveleti	42.7014	44.6283	1480 m	05.07.2019
Terek Valley, Gveleti Small Waterfall	42.7050	44.6147	1720 m	06.07.2019
Tkhilistskaro	41.8727	46.0050	337 m	09.07.2019
Tkibuli towards Ambrolauri, below Nakerala Pass	42.3869	43.0119	1110 m	02.07.2019
Truso Gorge at Terek	42.5797	44.4699	2023 m	07.07.2019
Truso Gorge, slope	42.5777	44.4647	2140–2212 m	07.07.2019
Truso Valley, flowery meadows and scree fields, 400 m E of Abano; Kazbegi Municipality	42.6039	44.3934	2180–2300 m	3.07.2019.
Truso Valley, steep mountain side with flowers and scree; Kazbegi Municipality	42.5869	44.4305	2130–2200 m	3.07.2019.
Tsdo Village	42.6928	44.6353	1750 m	17.07.2019
Tsdo, old road around the road tunnel	42.6900	44.6361	1620–1630 m	09.07.2019
Tsdo, small river valley close to the road tunnel	42.6842	44.6347	1600–1646 m	09.07.2019
Tsiprani, Pschawi-Aragwi	42.2345	44.8450	852 m	05.07.2019
Ughviri Lake	43.0319	42.8273	1905 m	13.06.2019
Ureki, Shekvetili	41.9410	41.7660	—	02.08.2019
Ushguli	42.9143	43.0077	2082 m	15.06.2019
Vachiani Lake	41.3600	43.4390	—	11.07.2019
Vashlovani NP, bungalows near border to Azerbaijan	41.1110	46.6470	—	26.–27.07.2019
Walk to Gveleti waterfall	42.7047	44.6204	1555 m	—
Way from Bakuriani to Borjomi	41.7940	43.4690	—	23.07.2019
Wetland N Kvakhvrel	41.9640	44.1700	—	09.07.2019